Diagnostic Yield of Bronchoscopy with C-Arm Scopy in Cases without Endobronchial Lesion

Endobronşiyal Lezyon Saptanmayan Olgularda C Kollu Skopi Eşliğinde Yapılan Bronkoskopinin Tanı Değeri

Jülide Çeldir Emre[1], Ayşegül Baysak[2], Adnan Tolga Öz[2], Gürsel Çok[3], Tuncay Göksel[3]
[1]Turgutlu State Hospital, Manisa, [2]Izmir University School of Medicine, Department of Chest Diseases Izmir,
[3]Ege University School of Medicine Department of Chest Diseases Izmir, Turkey

Özet

Amaç: Periferik akciğer lezyonlarında fiberoptik bronkoskopi (FOB) sırasında doku ya da sitoloji örneği elde etmek amacıyla C kollu skopi, tüm dünyada yaygın kullanım alanı bulmuştur. Gereç ve Yöntem: Prospektif olarak planlanan bu gözlem çalışmasında radyolojik olarak kitle lezyonu veya parankimal infiltrasyonu olan, ancak endobronşial lezyon saptanmayan olgularda C kollu skopi eşliğinde bronkoskopik biyopsi, fırçalama ve lavaj örnekleri alınarak tanısal değerleri karşılaştırıldı. Bulgular: Çalışmaya alınan 60 (E=45/K=15) hastanın yaş ortalaması 61.5±9.6 idi. Lezyonlar en sık sağ üst lobda saptandı. Hastaların 45'inde radyolojik olarak periferik kitle, 17'sinde nodül izlenirken; 18'inde konsolidasyon veya infiltrasyon saptandı. Biyopsi ile elde edilen tanı oranı %36 iken, fırçalamada %20, bronkoskopik lavajda %21 olarak değerlendirildi. Tüm yöntemlerle toplam tanı oranı %45 idi. Tümör çapına göre tanı oranı karşılaştırıldığında 3 cm'den büyük lezyonlarda %48.1 ve 3 cm'den küçük lezyonlarda %31.8 saptandı. 3 cm'den küçük lezyonlarda fırçalamanın istatistiksel olarak anlamlı bir şekilde etkisiz olduğu görüldü. Regresyon analizinde tanıya katkısı olan bağımsız faktör bulunmadı. İşlem sırasında hiçbir hastada ciddi bir komplikasyon gözlenmedi. Tartışma: Çalışmamızda C kollu skopi eşliğinde yapılan bronkoskopinin periferik lezyonların tanı etkinliğini arttıran güvenli bir yöntem olduğunu gözledik. Biyopsinin diğer yöntemlere göre daha etkili olduğu, ancak tanı duyarlılığını arttırmak için diğer yöntemlerle kombine edilmesi gerektiği, fırçalamanın 3 cm'den küçük lezyonlarda tanıya katkısının olmadığı sonucuna vardık.

Anahtar Kelimeler

Bronchoscopy; C-Arm Scopy; Diagnosis; Peripheral Pulmonary Lesion; Tumor

Abstract

Aim: Fiberoptic bronchoscopy (FOB) is widely used in the diagnosis and treatment of pulmonary diseases. FOB sensitivity is generally low in tumors localized in the outer third of the lung. Diagnosis of peripheral pulmonary lesions can be difficult; however, the use of computed tomography (CT)-, fluoroscopy- or ultrasonography (USG)-guided surgery increases the diagnostic rates. In this study we aimed to compare the diagnostic values of C-arm fluoroscopy-guided bronchoscopic lavage, brushing, and biopsy samples obtained in cases where radiological masses or parenchymal lesions were detected, but endobronchial pathology was not found. Material and Method: In this prospective observational study, bronchoscopy was performed to the patients who had a mass lesion or parenchymal infiltration on chest radiogram and who had no endobronchial lesion, the diagnostic results of the bronchoscopic lavage, brush and biopsy specimens have been compared where C-arm scopy guided the procedures. Results: 60 patients (45 male) with a mean age 61.5±9.6 were enrolled into the study. The lesions were mostly located in the right upper lobe. 45 patients had peripheral mass lesion, 17 patients had noduler lesion where consolidation or infiltration were present in 18 patients. The diagnostic yield of the bronchoscopic biopsy was 36%, brushing 20% and 21% for the bronchoscopic lavage. Overall diagnostic yield with all bronchoscopic methods was 45%. In lesions with a diameter of <3 cm, bronchoscopic brushing was significantly ineffective. There was not any severe complication due to these procedures. Discussion: The C-arm scopy guided bronchoscopic biopsy was much more valuable in the diagnosis of peripheral lesions.

Keywords

Bronchoscopy; C-Arm Scopy; Diagnosis; Peripheral Pulmonary Lesion; Tumor

DOI: 10.4328/JCAM.3049 Received: 03.11.2014 Accepted: 27.11.2014 Printed: 01.07.2016 J Clin Anal Med 2016;7(4): 449-53
Corresponding Author: Ayşegül Baysak, Izmir University School of Medicine, Dept. of Chest Diseases, Karsiyaka, Izmir, Turkey.
T.: +90 2323995050 F.: +90 2323995078 E-Mail: drbaysak@gmail.com

Introduction

Fiber optic bronchoscopy (FOB) is widely used in the diagnosis and treatment of pulmonary diseases, particularly in the evaluation, diagnosis, and treatment of endobronchial lesions. FOB is an extremely safe procedure provided basic precautions are taken.

FOB sensitivity is generally low in tumors localized in the outer third of the lung; i.e. in the parenchyma where the airways are generally normal in malignant people. Diagnosis of peripheral pulmonary lesions can be difficult; however, the use of computed tomography (CT)-, fluoroscopy- or ultrasonography (USG)-guided surgery increases the diagnostic rates. However, whether bronchoscopic inspection or percutaneous intervention is the optimal diagnostic medium for peripheral pulmonary lesions is unclear [1].

FOB under fluoroscopy is thought to be an effective and reliable first inspection method for the diagnosis of the pulmonary lesions with a diameter larger than 2 cm [2]. Shiner et al. [3] reported that bronchoscopy carried out on 71 patients with lesions larger than 2 cm did not detect endobronchial lesions and had a diagnostic ratio of 33% (11–76%).

Fluoroscopic guidance is technically less difficult, costs less, and requires less procedure time than CT guidance. The pneumothorax ratio is higher in CT-guided than fluoroscopy biopsies [4-6]; in fact, serious complications are rare in fluoroscopy-guided surgery [7]. The most common complication associated with fluoroscopic guidance is hemorrhage; however, it is generally not serious enough to require treatment. Complications such as pneumothorax, hemomediastinum, and damage to the bronchoscope are rare. The technique has been shown to be reliable for high-risk cases such as older age groups, emphysema, and cardiac disease [8-10].

Endobronchial lesion biopsy has a high diagnostic value for lesions that can be seen using a bronchoscope [11, 12]; however, the diagnostic values for transbronchial biopsy under fluoroscopy and brushing are high for peripheral lesions that cannot be seen using a bronchoscope [12-15].

The present study compared the diagnostic values of C-arm fluoroscopy-guided bronchoscopic lavage, brushing, and biopsy samples obtained in cases where radiological masses or parenchymal lesions were detected, but endobronchial pathology was not found.

Material and Method

The present prospective observational study compared the diagnostic values of routine bronchoscopic sampling methods. The study included patients scheduled for bronchoscopy for various reasons in which samples were obtained using C-arm fluoroscopy. We enrolled 60 consecutive patients with no endobronchial lesions between February-2005 and September-2007. The study was approved by the Ethics Committee of Ege University, and all patients provided written informed consent prior to entry into the study.

Radiological masses or parenchymal infiltration were detected in the lung and first lavage, followed by brushing and then biopsy sampling on the cases where no endobronchial lesions were observed during FOB under C-arm fluoroscopy guidance.

Biopsy samples were sent to the pathology laboratory in a formalin solution, and brush samples were immediately fixed in 70% alcohol.

Prior to the biopsy, a medical history was taken and a physical examination and chest radiography were performed on all patients. A CT scan was routinely used to determine the location and characteristics of the lesion and to locate the site for the biopsy.

The inclusion criteria were: over the age of 18, a mass lesion or parenchymal infiltration on the chest radiogram, no endobronchial lesion detected using FOB, and cardiopulmonary stability and the ability to tolerate bronchoscopy. Patients with an endobronchial lesion, thrombocyte count <50000/mm3, or neutrophil count <1000/mm3 were excluded from the study.

Prior to surgery, the patients received premedication with subcutaneous morphine HCl (5–10 mg) and 2% lidocaine for local anesthesia. Midazolam was used to achieve deep sedation during surgery. The midazolam dose was adjusted for each patient with a maximum dose of 5 mg.

Patients were placed in the supine position and the FOB (Olympus videobronchoscope CLE-10, USA) was inserted through the transnasal or transoral route. Blood pressure, electrocardiogram (ECG), heart rate, and oxygen saturation were monitored during surgery in all patients. We used a Siemens Siremobil Compact L brand C-arm for fluoroscopy.

We used a registration form to collect demographic, clinical, radiological, and laboratory data and information concerning the cancer and bronchoscopic findings (i.e., view, monitoring, operations carried out, complications, and the results of the measures taken).

The Statistical Package for the Social Sciences 16.0 (SPSS Inc., Chicago, IL, USA) was used to conduct the statistical tests. Chi-squared tests were used to compare non-parametric variables and t-test were used to compare parametric outcomes. A regression analysis was carried out to evaluate factors contributing to diagnostic success.

Results

The study included 60 patients (45 male and 15 female) with a mean age of 61.5 ± 9.6. The most frequent symptoms were cough (56.7%), chest pain (23.3%), and dyspnea (20%). Lesions were most frequently detected in the right upper lobe. A peripheral mass >3 cm was detected on the chest radiogram in 27 patients, a peripheral nodule <3 cm was detected in 22 patients, and peripheral localized consolidation or infiltration was detected in 11 patients. A total of 30 patients (50%) were active smokers and 20 (33.3%) patients were nonsmokers while 10 (17.7%) patients were ex-smokers.

Surgery was performed most frequently on the right upper lobe (43.3%) and the apical segment of the right upper lobe (18.3%; Figures 1 and 2).

More than one biopsy was obtained during bronchoscopic surgery. Five biopsies were obtained from seven (11.7%) cases, four were obtained from 38 (63.3%) cases, three from 11 (18.3%) cases, two from two (3.3%) cases, and one biopsy was obtained from two (3.3%) cases. No statistically significant difference was found between the number of biopsies obtained and the diagnostic ratio. The diagnoses and sampling method used are shown in Table 1.

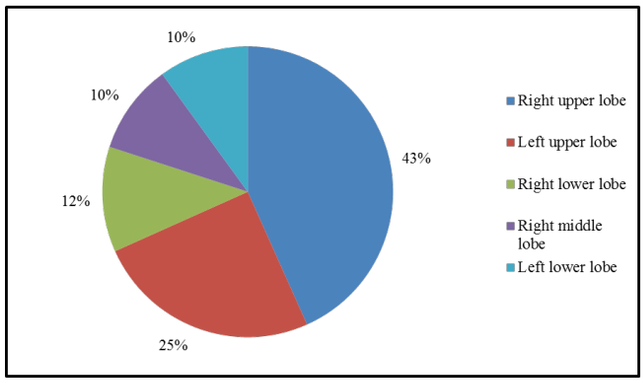

Figure 1. The distribution of the processing sites according to lobes

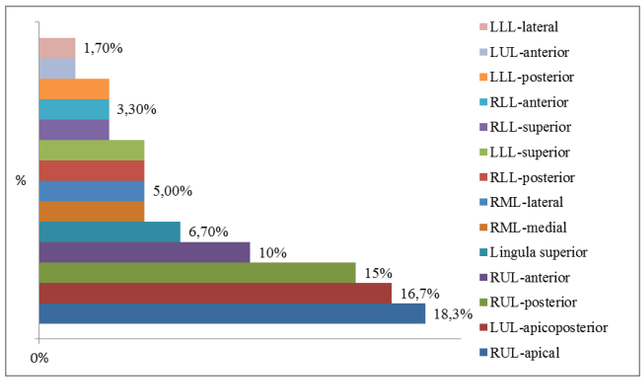

Figure 2. The distribution of the processing sites according to segments of lung

Table 1. Diagnoses of the cases and performed operations

Patient	Diagnosis	Biopsy	Brushing	Lavage	CT guided TFNAB	Operation	Other
1	Lung Adeno Cancer	-	-	-		+	
2	Squamous Cell Lung Cancer	+	+	+			
3	NSCLC	+	+	-			
4	Radiological Lung Cancer	-	-	-			+
5	Lung Adeno Cancer	-	-	-	+		
6	SCLC	+	+	+			
7	NSCLC	-	-	-			+
8	Pulmonary Fibrosis	+	-	-			
9	NSCLC	-	-	-		+	
10	BOOP	+	-	-			
11	SCLC	-	+	-			
12	Pulmonary Fibrosis	+	-	-			
13	NSCLC	-	-	-		+	
14	NSCLC	-	-	-			+
15	SCLC	+	+	+			
16	Lung Adeno Cancer	-	-	-		+	
17	Radiological Lung Cancer	-	-	-			+
18	NSCLC	-	-	-	+		
19	Pulmonary Fibrosis	-	-	-			+
20	Sarcoidosis	+	-	+			
21	Pneumonia	+	-	+			
22	NSCLC	+	-	-			
23	NSCLC	+	-	-			
24	Lung Adeno Cancer	-	-	-		+	
25	Tuberculose	-	-	+			
26	Radiological Lung Cancer	-	-	-			+
27	Lung Adeno Cancer	+	-	-			+
28	Normal	-	-	-	-		+
29	Pneumonia	+	-	-			
30	Lung Adeno Cancer	-	-	-		+	
31	Radiological Lung Cancer	-	-	-			+
32	Normal	-	-	-			+
33	NSCLC	+		-			
34	NSCLC	-	-	-	+		
35	Radiological Lung Cancer	-	-	-			+
36	Radiological Lung Cancer	-	-	-			+
37	Radiological Lung Cancer	-	-	-			+
38	Squamous Cell Lung Cancer	+	+	-			
39	Squamous Cell Lung Cancer	-	+	+			
40	NSCLC	-	-	-	+		
41	Tuberculose	-	-	-		+	
42	Lung Adeno Cancer	-	-	-	+		
43	Lung Adeno Cancer	+	+	+			
44	Lung Adeno Cancer		-	-		+	
45	Lung Adeno Cancer	-	-	-	+		
46	Radiological Lung Cancer	-	-	-			+
47	Carcinoid Tumour	-	-	-	+		
48	SCLC	+	-	-			
49	Metastatic Lung Cancer	-	-	-		+	
50	Pneumonia	-	+	+			
51	Squamous Cell Lung Cancer	-	-	+			
52	NSCLC	-	-	-	+		
53	NSCLC	+	+	-			
54	Lung Adeno Cancer	-	-	-	+		
55	Sarcoidosis	+	-	-			
56	Metastatic Lung Cancer	+	+	-			
57	Radiological Lung Cancer	-	-	-			+
58	Pneumonia	+	-	+			
59	Pneumonia	+		+			
60	NSCLC	-	-	-	+		
Total	Diagnosed patients	22	11	12	10	9	15

(+): There is diagnosis (-): There is no diagnosis

The diagnostic ratio was 36.7% for biopsy, 20% for bronchoscopic brushing, and 21.7% for bronchoscopic lavage (Figure 3). The total diagnostic ratio combining all sampling methods was 45%. Alternative methods were used for patients who could not be diagnosed using these sampling methods, those diagnostic ratios were: 25% for transthoracic fine-needle aspiration biopsy; 15% for surgery, and 15% for other methods (lymph node biopsy, metastasectomy, radiological detected but not pathologically proven tumor). The various surgeries performed are shown in Table 2.

The radiological sizes of the lesions are shown in Figure 4. Assessment according to tumor diameter revealed diagnostic ratios of 48.1% for lesions >3 cm and 31.8% for the lesions <3 cm (Figures 4 and 5). We found that that brushing did not detect lesions <3 cm. ($p = 0.02$). The regression analysis revealed no independent factors that contributed to the diagnosis.

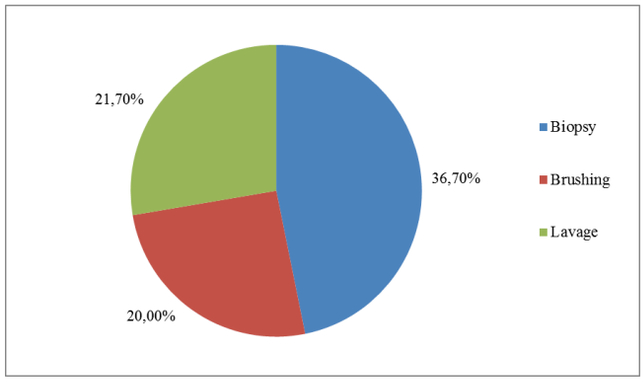

Figure 3. Success rate of the sampling methods

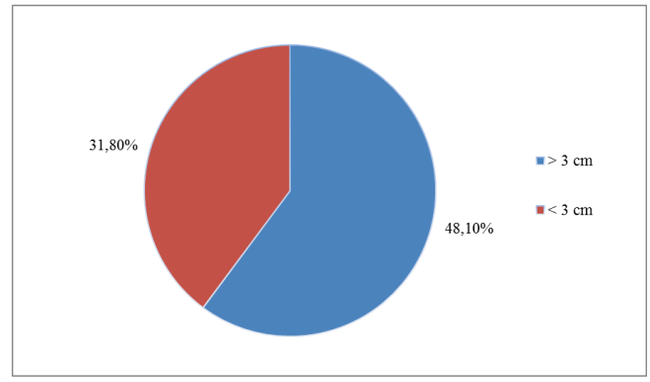

Figure 5. The diagnosis rate based on radiological size

Table 2. Bronchoscopic methods according to diagnoses (n)

Diagnoses	Biopsy	Brushing	Lavage	TFNAB	Operation	Other	Total
NSCLC	5	3	1	5	2	1	14
Adeno Cancer	2	1	1	3	5	2	11
Squamous Cancer	2	3	3				4
SCLC	2	3	2				4
Carcinoid Tumour					1		1
Metastatic Lung Cancer	1	1			1		2
Tuberculose			1	1			2
Pneumonia	3	1	3				5
Fibrosis	2					1	3
Sarcoidosis	2						2
BOOP	1						1
Non-diagnosed							2
Radiological Lung Ca							9
Total	20	12	11	9	9	4	60

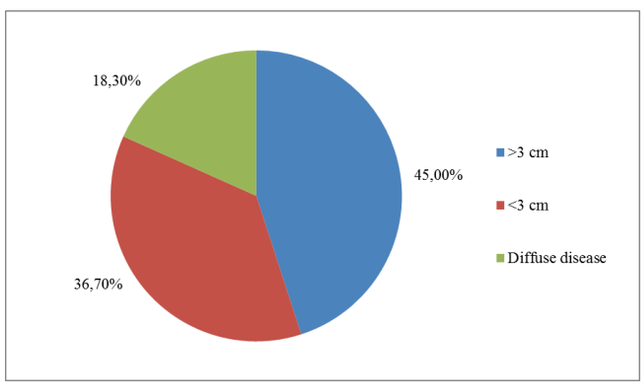

Figure 4. The distribution of the lesions based on their radiological size

Discussion

The present prospective study, carried out over a two and a half years, revealed a diagnostic ratio of 36% for biopsy, 20% for brushing, and 21% for bronchoscopic lavage. The total diagnostic ratio, the combination of all methods, was 45%. No serious surgery-related complications were observed in any patient.

C-arm fluoroscopy is widely used to obtain tissue or cytology samples during FOB for peripheral pulmonary lesions. The total diagnostic rate using fluoroscopy-guided biopsy, brushing, and aspiration has been reported to be 40–80% and the false-positive ratio was low [16, 17]. Evaluation of the bronchoscopic diagnostic methods individually revealed diagnostic ratios of 15–46% for biopsy, 29–50% for brushing, and 42–46% for aspiration [16]. The use of fluoroscopy increases the diagnostic ratio by 10–30% [17].

Cortese et al. [18] assessed 45 patients with pulmonary metastatic, but not endobronchial, lesions, and obtained a total diagnostic rate of 53% and a 47% diagnostic rate for biopsy, 22% for brushing, and 17% for lavage using fluoroscopy. A previous fluoroscopy-guided study conducted in 452 patients revealed a diagnostic ratio of 55.2% for biopsy [19].

The authors reported that as the number of biopsies increased, the diagnostic ratio increased (diagnostic rate of 52% for ≤4 and 70% for >4 biopsies) [19]. In contrast, we obtained three to four bronchoscopic biopsies from 49 cases, but did not find a statistically significant relationship between number of biopsies and diagnostic ratio. This difference may be explained by the fact that the distribution between biopsy numbers and case numbers was not homogenous in our study. Previous studies that have found an association between biopsy number and an increase in diagnostic rate recommend that at least four biopsies are obtained from each patient [19, 20].

Cortese et al. [18] reported diagnostic rates of 64% for tumors larger than 2 cm in diameter, and 28% for lesions smaller than 2 cm. In another study, fluoroscopy-guided diagnostic surgery was found to be ineffective for lesions less than 1.1 cm in diameter [21].

Assessment of diagnostic ratio according to tumor diameter revealed rates of 48.1% for lesions larger than 3 cm and 31.8% for those smaller than 3 cm. The brushing method was not effective for lesions smaller than 3 cm. ($p = 0.02$).

In a comparison of endobronchial ultrasound (EBUS) and fluoroscopy, Herth et al. [22] found fluoroscopy to be preferable because of its low cost and high diagnostic rate. However, both fluoroscopy and EBUS have been reported to be reliable diagnostic methods for lesions smaller than 3 cm [23].

Herth et al. [24] reported that EBUS detected 48 of 54 lesions smaller than 3 cm that could not be detected using fluoroscopy, and that 38 diagnoses were made resulting in a 70% diagnostic rate.

Ensminger and Prakash [25] reported a 55% diagnostic rate for 107 biopsies obtained using fluoroscopy on patients with diffuse pulmonary disease, but no endobronchial lesions. They found that the technique was clinically useful in 75% of procedures. In another study the authors concluded that fluoroscopy-

guided bronchoscopic procedure performed on cases of diffuse lung disease significantly increased the diagnostic rate [26].

Diagnostic rates have been found to be higher at facilities that use EBUS. Using multiple diagnostic methods based on the case and combining sampling techniques increases the success rate of diagnosis [27]. In our study, biopsy was found to be the most effective sampling method with a diagnostic ratio of 36%; however, the addition of brushing and lavage sampling increased the success rate to 45%.

Fluoroscopy increases the reliability of sampling, particularly when obtaining a biopsy from a peripheral lesion for transbronchial biopsy. Fluoroscopy-guided surgery has been reported to decrease the risk of pneumothorax; although the risk of pneumothorax is less than 1.8% when guided by fluoroscopy, it has been reported to be as high as 2.9% when fluoroscopy-guided surgery was not used [28]. A previous study reported a pneumothorax rate of 5.8%, and while 3.8% required a thorax tube, major hemorrhage was observed in 0.2% of the patients [29, 30]. No serious complications were observed in our study.

Fluoroscopic guidance is technically less difficult, costs less, and has a lower complication risk than the CT guidance. Furthermore, the pneumothorax ratio is higher in CT-guided (40–50%) than in fluoroscopy-guided surgery. Finally, fluoroscopy-guided FOB is a reliable method.

Fluoroscopy-guided transbronchial needle aspiration (TBNA) has made a significant contribution to the diagnostic efficacy of fluoroscopy at a ratio of 20% (7–35%); and its diagnostic efficacy varies between 35% and 69%. In general, the bronchoscopy diagnostic rate decreases for lesions smaller than 3 cm located at the lateral end of the midclavicular line.

Conclusions: We observed that C-arm fluoroscopy-guided bronchoscopy reliably increased the diagnostic efficacy for peripheral lesions. Our findings suggest that biopsy was more effective than the other sampling methods; however, combining the methods increased diagnostic sensitivity with the exception that brushing was not effective for diagnosis of lesions smaller than 3 cm.

Authors' contributions: JCE, TG and GC contributed to study design and execution. JCE, AB and ATO drafted the manuscript. JCE, AB and TG coordinated the study and reviewed the manuscript. TG and GC reviewed and commented on manuscript drafts. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

References

1. Akkoçlu A. Akciğer kanserinde tanı ve evrelendirmede girişimsel yöntemler. In: Akkoçlu A, ed. TAKD Kitaplari. Sayı 1, İzmir; 2006.p.9-18.
2. Pirozynski M. Bronchoalveolar lavage in the diagnosis of peripheral, primary lung cancer. Chest 1992;102(2):372-4.
3. Shiner RJ, Rosenman J, Katz I, Reichart N, Hershko E, Yellin A. Bronchoscopic evaluation of peripheral lung tumors. Thorax 1988;43(11):887-9.
4. Van Sonnenberg E, Casola G, Ho M, Neff CC, Varney RR, Wittich GR et al. Difficult thoracic lesions: CT-guided biopsy experience in 150 cases. Radiology 1988;167(2):457-61.
5. Mak VH, Johnston ID, Hetzel MR, Grubb C. Value of washings and brushings at fiberoptic brochoscopy in the diagnosis of lung cancer. Thorax 1990;45(5):373-6.
6. Sterman DH. Bronchoscopy, transthoracic needle aspiration, and related procedures. In: Fishman AP, ed. Fishman's Manuel of Pulmonary Diseases and Disorders. Third ed. New York: McGraw Hill; 2002.p.75-82.
7. Utz JP, Prakash UBS. Indications for and contraindications to bronchoscopy. In: Prakash UBS, ed. Bronchoscopy. Philadelphia: Lippincott-Raven, 1997.p.81-9.
8. Tachihara M, Ishida T, Kanazawa K, Sugawara A, Watanabe K, Uekita K et al. A virtual bronchoscopic navigation system under X-ray fluoroscopy for transbronchial diagnosis of small peripheral pulmonary lesions. Lung Cancer 2007;57(3):322-7.
9. Cortese DA, McDougall JC. Biopsy and brushing of peripheral lung cancer with fluoroscopic guidance. Chest 1979;75(2):141-5.
10. Denis AC, McDougall JC. Bronchoscopy in peripheral and central lesions. In: Prakash UBS, ed. Broncoscopy. Mayo Foundation Raven Press New York; 1994.p.135-53.
11. Savage C, Morrison RJ, Zwischenberger JB. Bronchoscopic diagnosis and staging of lung cancer. Chest Surg Clin N Am 2001;11(4):701-21.
12. de Gracia J, Bravo C, Miravitlles M, Tallado N, Orriols R, BellmuntJ et al. Diagnostic value of bronchoalveolar lavage in peripheral lung cancer. Am Rev Respir Dis 1993;147(3):649-52.
13. Ovassapian A. The flexible bronchoscope. A tool for anesthesiologists. Clin Chest Med 2001;22(2):281-99.
14. Simpson FG, Arnold AG, Purvis A, Belfield PW, Muers MF, Cooke NJ. Postal survey of bronchoscopic practice by physicians in the United Kingdom. Thorax 1986;41(4):311-7.
15. Honeybourne D. Survey of flexible fibreoptic bronchoscopy in the UK. Eur Respir J 2002;20(3):789.
16. Arroliga AC, Matthay RA. The role of bronchoscopy in lung cancer. Clin Chest Med 1993;14(1):87-98.
17. Gasparini S, Ferretti M, Secchi EB, Baldelli S, Zuccatosta L, Gusella P. Integration of transbronchial and percutaneous approach in the diagnosis of peripheral pulmonary nodules or masses. Experience with 1027 consecutive cases. Chest 1995;108(1):131-7.
18. Cortese DA, McDougall JC. Bronchoscopic biopsy and brushing with fluoroscopic guidance in nodular metastatic lung cancer. Chest 1981;79(5):610-1.
19. Milman N, Faurschou P, Munch EP, Grode G. Transbronchial lung biopsy through the fibre optic bronchoscope. Results and complications in 452 examinations. Respir Med 1994;88(10):749-53.
20. Uchida J, Imamura F, Takenaka A, Yoshimura M, Ueno K, Oda K et al. Improved diagnostic efficacy by rapid cytology test in fluoroscopy-guided bronchoscopy. J Thorac Oncol 2006;1(4):314-8.
21. Mori K, Yanase N, Kaneko M, Ono R, Ikeda S. Diagnosis of peripheral lung cancer in cases of tumors 2 cm or less in size. Chest 1989;95(2):304-8.
22. Herth FJ, Ernst A, Becker HD. Endobronchial ultrasound-guided transbronchial lung biopsy in solitary pulmonary nodules and peripheral lesions. Eur Respir J 2002;20(4):972-4.
23. Hansra IK, Ernst A. Bronchoscopic-directed diagnosis of peripheral lung lesions suspicious for cancer. Thorac Surg Clin 2007;17(2):159-65.
24. Herth FJ, Eberhardt R, Becker HD, Ernst A. Endobronchial ultrasound-guided transbronchial lung biopsy in fluoroscopically invisible solitary pulmonary nodules: A prospective trial. Chest 2006;129(1):147-50.
25. Ensminger SA, Prakash UB. Is bronchoscopic lung biopsy helpful in the management of patients with diffuse lung disease? Eur Respir J 2006;28(6):1081-4.
26. Ernst A, Feller-Kopman D, Herth FJ. Endobronchial ultrasound in the diagnosis and staging of lung cancer and other thoracic tumors. Semin Thorac Cardiovasc Surg 2007;19(3):201-5.
27. Yoshikawa M, Sukoh N, Yamazaki K, Kanazawa K, Fukumoto S, Harada M et al. Diagnostic value of endobronchial ultrasonography with a guide sheath for peripheral pulmonary lesions without X-ray fluoroscopy. Chest 2007;131(6):1788-93.
28. Chechani V. Bronchoscopic diagnosis of solitary pulmonary nodules and lung masses in the absence of endobronchial abnormality. Chest 1996;109(3):620-5.
29. Bolliger CT, Mathur PN, Beamis JF, Becker HD, Cavaliere S, Colt H et al. ERS/ATS statement on interventional pulmonology. European Respiratory Society/American Thoracic Society. Eur Respir J 2002;19(2):356-73.
30. Levy H, Kallenbach JM, Feldman C, Pincus P, Hurwitz M. Delayed pneumothorax after transbronchial lung biopsy. Thorax 1986;41(8):647-8.

How to cite this article:
Emre JÇ, Baysak A, Öz AT, Çok G, Göksel T. Diagnostic Yield of Bronchoscopy with C-Arm Scopy in Cases without Endobronchial Lesion. J Clin Anal Med 2016;7(4): 449-53.